rhic beam rapidity

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beam rapidity calculation:

for RHIC Au+Au run at $\sqrt{s_{NN}} = 19.6$ GeV, energy of each nucleon is 9.8 GeV.

according to relativity $E = \gamma mc^2$. Thus, β and y can be calculated as follows

$$\gamma = \frac{9.8}{0.9315} \tag{1}$$

$$\gamma = \frac{1}{\sqrt{1 - \beta^2}} \tag{2}$$

$$\beta = \sqrt{1 - \frac{1}{\gamma^2}} \tag{3}$$

$$y = \operatorname{arctanh}\beta \tag{4}$$

$$\approx 3.04 \tag{5}$$

similar calculations for $\sqrt{s_{NN}} = 130$ and 200 GeV yield $y_{\text{beam}} \approx 5.63$ and 6.06, respectively.